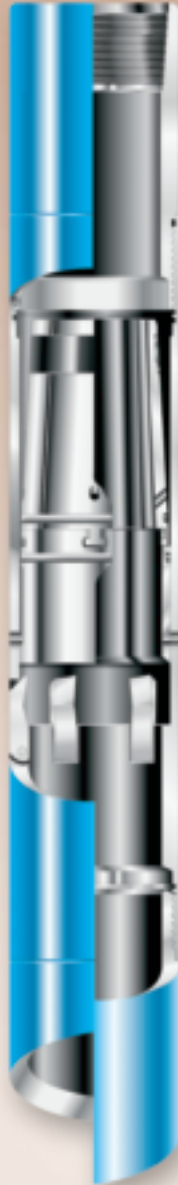


HYDRAULIC EXTERNAL CUTTERS

Instruction Manual 5550



Hydraulic External Cutters

Hydraulic External Cutters

INDEX

Hydraulic External Cutters

General Description	3
Uses	3
Construction	3
Operation	3
Maintenance	5
Disassembly	5
Reassembly	5
Exploded View	6
Maximum Loads and Lengths	7
Piston Assembly Sizes	8
Specifications and Replacement Parts	9

The designs and specifications for the tools described in this instruction manual were in effect at the time this manual was approved for printing. National Oilwell Varco, whose policy is one of continuous improvement, reserves the right to discontinue models at any time, or to change designs and specifications without notice or without incurring obligation.

Eighth Printing, September 2005

General Description

Bowen Hydraulic External Cutters are hydraulically actuated mechanical tubing and drill pipe cutters. The cutters are fast, efficient, smooth cutting, and are capable of cutting and recovering strings of tubing or drill pipe. The cutter Knives are fed entirely by pump pressure, thus giving the operator sensitive control.

Uses

Used in conjunction with a washover string, the Bowen Hydraulic External Cutter may be used to cut and remove stuck pipe. They are capable of cutting all types of drill pipe or tubing, regardless of tool joint style.

Construction

Simple, yet rugged, Bowen Hydraulic External Cutters are composed of a Top Sub, Body, Guide, a set of Knives, and a Segmented Piston Assembly. Two Shear Pins hold the Piston in a "running in" position until they are sheared to begin the cut.

The Piston Assembly is composed of a Rubber Ring and a set of interlocking, conical piston segments. The segments are held in a contracted position by a tough Rubber Ring stretched around the end of the segments in a suitable groove. Each piston segment has a fluid passage which is engineered to simultaneously pass fluid for flushing, cooling, and restricting the fluid flow for ample pump-down force on the Knives to effect the cut.

The Top Sub is threaded into the Body. It has a suitable running string connection on the top end. The inner parts of the External Cutter are maintained in position by the Top Sub.

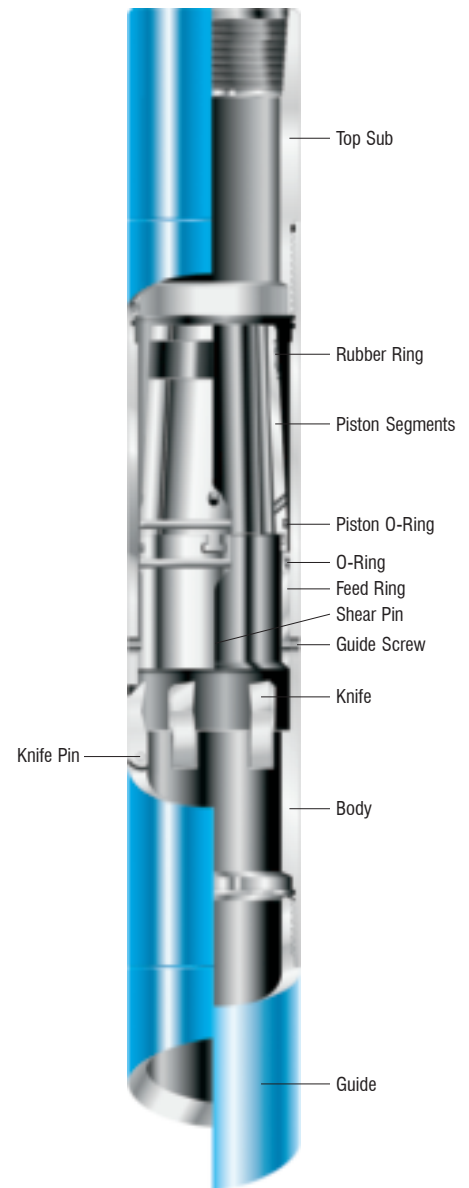
The Body has knife slots on its lower end and threaded connections top and bottom, to accept the Top Sub and Guide. The Knife slots incorporate crossholes for the Knife Pins. Two drilled holes are arranged diametrically opposite each other in the Body, for the Shear Pins.

The Guide is threaded into the bottom of the Body. Its purpose is to guide the fish into the Cutter. The Guide is usually cut-lipped. An alternate guide, such as an extra long wall hook, or mill-toothed guide may be substituted if required.

The Knives are made from tool steel, shaped at the cutting end for most efficient cutting action, and tempered for strength and toughness. The shank end is radius formed to match the concave bearing face against which it rests in the Cutter Body. These Bearing Blocks are an integral part of the Body.

Operation

Before running the Bowen Hydraulic External Cutter, a washover operation is necessary to free the stuck pipe from the formations. The washpipe is equipped with a washover shoe having an outside diameter slightly larger and an inside diameter slightly smaller than the Bowen Hydraulic External Cutter to be used. (A Bowen Rotary Washover Shoe is recommended.) This is to establish adequate clearance so that the Cutter may be lowered over the stuck pipe. It is recommended further that the stuck pipe be washed over for at least one full joint, below where the cut is to be made, so that the stuck pipe will be centralized in the hole at the point of the cut.



Hydraulic External Cutter

After washing-over the stuck pipe for the desired distance, the washover string is withdrawn from the well and the wash-over shoe is removed from the bottom of the string. The washover shoe is then replaced with the Bowen Hydraulic External Cutter.

Assemble the Cutter using the proper size piston assembly and run in the hole. When desired depth is reached, start the mud pump with all lines open, to be sure no pressure is pumped down hole. With the pump at an idle, slowly close the by pass valve to pump fluid through the working string until the pressure reaches approximately 145 psi which will shear the pins. Open the by pass valve to release the pressure from the working string.

Begin slow rotation at 15 to 25 rpm; slowly close the by pass valve again to pump fluid down the working string. This will begin feeding the knives to start the cut. The amount of pressure and gallons per minute required depends on the size cutter and piston assembly being used.

See page 7.

Use extreme caution to avoid surging of pump pressure when starting a cut. Pressure surging causes the string length to expand and contract, moving the cutter up and down. This motion prevents the knives from remaining in one position when making a cut and may easily break a knife tip.

Another method for shearing the pins, is to raise the string until the Piston Assembly shoulders under a collar. Approximately 377 lbs. pull will then shear one pin and 754 lbs. pull will shear two pins.

Running-In Precautions

1. Care should be exercised when going over the top of the fish. Whenever possible, rotate the Cutter to the right to feed the fish into the guide.
2. After the fish has entered the Cutter, the Cutter must not be raised more than absolutely necessary. When pulling the rotary slips on the rig, the cutting string should be lifted only high enough to free them. If the Cutter is lifted against a collar, the pins will be sheared. This will allow the feed ring to force the Knives against the pipe. Should this occur, a cut should be made then to avoid passing another collar and damaging the Knives.
3. Once the piston segments are run past a collar, it may not be pulled back. Special piston segments with a threaded front edge are available, if this is a concern. They may be walked over a coupling with right hand torque.

Cutting Precautions

1. When selecting the proper place to make the cut, it is recommended that the cut be made one joint above the lowest position to which the rotary washover shoe was run. This will leave one joint of free pipe below the Cutter which will spring away from the wall and align itself in the cutter.
2. After the Kelly or Bowen Power Sub or Bowen Power Swivel, whichever is being used, is attached to the drill pipe, the cutting string is rotated to a free position. The pumps should then be turned on at a slow rate, allowing the pipe to be cut with a minimum torque.

Proving the Cut

Normally, when the pipe is severed by the Bowen Hydraulic External Cutter, torque will drop and there will be a noticeable increase on the weight indicator.

To prove a cut, the drill pipe string should first be raised 1" to 2" or until there is from two to three points additional load shown on the indicator, this being sufficient to lift the cut portion of the fish. The raising is done to avoid pinching the Knives between the portion of the fish that has been cut and the fish remaining in the hole.

After raising, the string should be rotated. If the string rotates freely, it is almost conclusive proof that the cut has been successfully made. The pipe should again be raised carefully, and if no additional obstacles are encountered, all of the string may be hoisted and the fish removed from the hole.

Several other changes in the Cutter's action may indicate to the operator that a cut has been completed. For example: If a short fish is being cut, the speed of rotation may increase and the Cutter will run free immediately after the cut is completed. If a long fish being cut, the portion of the fish above the cutter may be heavy enough to pinch the Knives against the lower portion of the fish, making forward rotation impossible. The Cutter may rotate smoothly, although the Knives are slightly pinched, but additional torque is required to rotate. Finally, the weight indicator may suddenly rise while rotating, indicating completion of the cut.

Coming Out of the Hole

After completing the cut, the Cutter should be withdrawn carefully for two or three joints. Normal withdrawing operations may then proceed.

Maintenance

The Bowen Hydraulic External Cutter should be thoroughly washed and cleaned to remove all drilling mud and other debris. All parts, particularly the Knives, should be examined for wear and damage and replaced as necessary. It is recommended that the Bowen Hydraulic External Cutter be completely disassembled, cleaned, lubricated, painted, and reassembled before storing.

Disassembly

1. At the rig, when the Bowen Hydraulic External Cutter is removed from the well, it should be thoroughly washed down with clean water to remove all excess drilling mud, etc. At this time it is advisable to break the Top Sub from the Body with the rig tongs to point where it may be uncoupled by hand.
2. Remove the entire assembly to a place that is clean and convenient for disassembly.
3. Clamp the Cutter in a suitable vise, near the center of its length.

CAUTION: Do not over tighten on thin wall section.

4. Loosen and remove the Top Sub.
5. Remove Piston Assembly.
6. Slide out and remove the Feed Ring.
7. Using a suitable punch, remove the sheared halves of the Shear Pins from the Body.

8. With a socket head set screw wrench, remove the several (usually 5) Set Screws which lock the Knife Pins in place.

9. Remove the Knife Pins by pushing them out with a small brass rod or punch.

CAUTION: These Knife Pins have shoulders, so must be removed from the end of their hole which has the Set Screw holes. They cannot be removed from the other end. The knives will fall free when the Knife Pins are removed.

10. Loosen and remove the Guide from the lower end of the Body.
11. With a suitable punch, remove the sheared halves of the Shear Pins from the Feed Ring.

CAUTION: Care should be taken when removing sheared pins from the Body and the Feed Ring, not to distort or otherwise damage the shear pin holes.

After disassembly, all parts should be thoroughly cleaned and examined for signs of advanced wear or damage. The interior of the Body should be free of marks or scratches, bits of shear pin or other loose debris.

The Feed Rings should also be free of marks and scratches. Any distortion on edges should be dressed down with a hand file.

All Knives should be in perfect condition for reuse. If they are not, they should be replaced. Very minor wear or damage may sometimes be repaired by skillfully regrinding, but it is important that the proper contour and the overall length of each Knife be maintained.

Reassembly

1. Clamp the Body in a vise near the center of its length.
2. Assemble the Knives in the Body. Position a Knife in the Body with the cutting face toward the inside. Slip a Knife Pin through the hole provided in the Body, through the Knife and into the remainder of the pin hole. Insert a Set Screw and tighten. The Knife may be wedged in place by using a strand of soft rope or a piece of hemp string. This will maintain the Knife in position while the remaining Knives are assembled, and during subsequent handling and operation.
3. After all Knives have been assembled, attach the Piston Assembly to the Feed Ring.
4. Insert Feed Ring and Piston Assembly into Body so that the two shear pin holes on the Feed Ring align with the two shear pin holes on the Body.
5. Insert the two Shear Pins in the holes on the Body and on the Feed Ring.

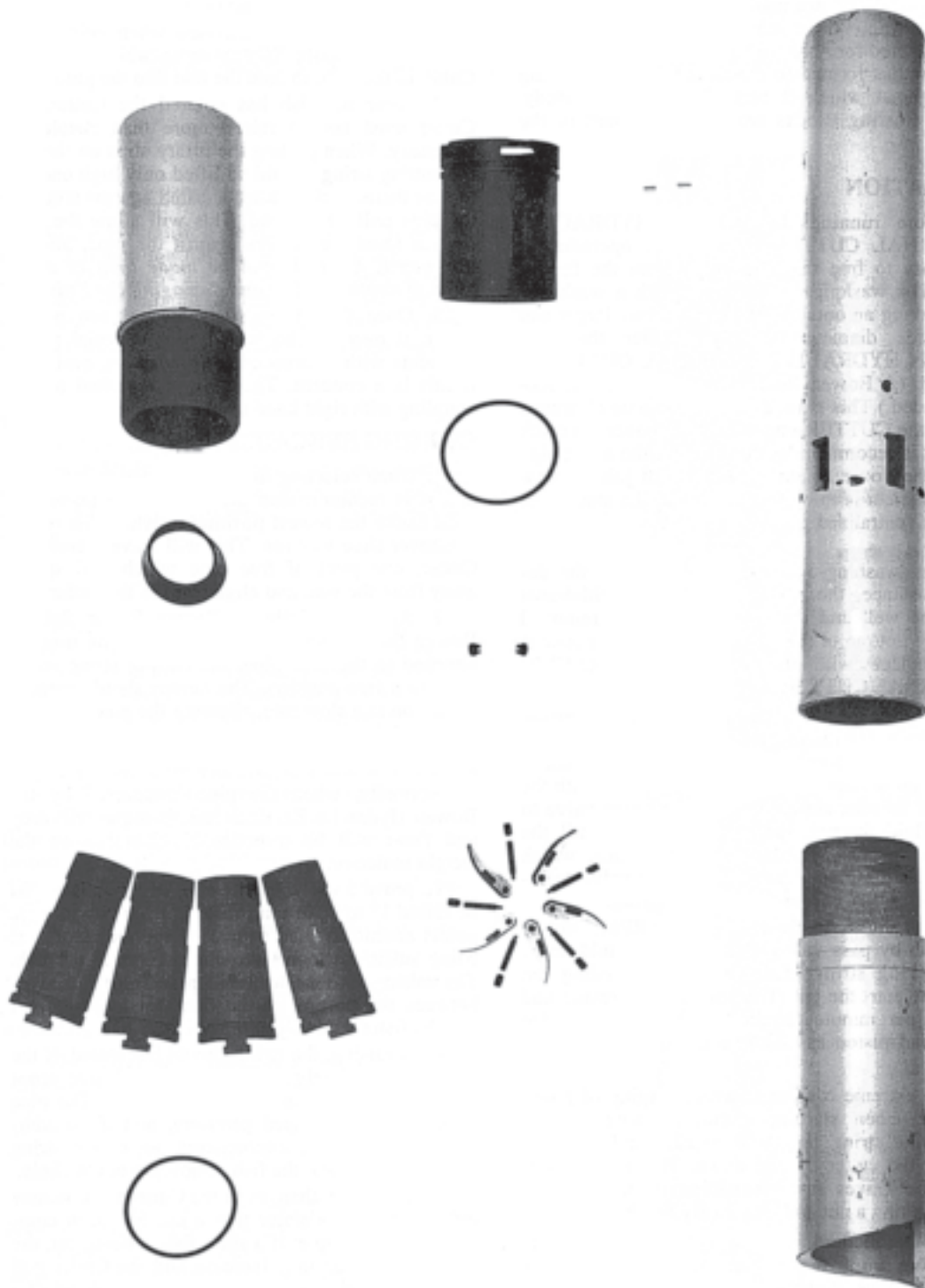
NOTE: Do NOT use brass welding rod for shear pins. Use only quality tested and proven brass pins from a National Oilwell/Bowen dealer.

Be sure to use a good quality clean thread dope on the Top Sub and Guide connections.

NOTE: The ends of the Shear Pins may be upset slightly with a small hammer, causing them to fit the shear pin holes more snugly.

6. Insert the Top Sub in the Body and make it up tight.
7. Assemble the Guide on the lower end of the Body.

Exploded View



Maximum Length and Load of Tubing and Drill Pipe
Approximate Pressure and GPM Required to Make Cut

Tubing and Drill Pipe Size	Cutter No.	Length (ft)	Load (lbs)	Approximate psi	Approximate gpm
2-1/16 Tbg.	70086	1,979	7,910	30 – 40	200
1.900 Tbg.		1,400	4,060	25 – 35	220
1.600 Tbg.		1,293	3,100	20 – 30	125
1.315 Tbg.		1,409	2,530	20 – 30	120
2-3/8 Tbg.	34415	710	3,340	35 – 45	200
2-1/16 Tbg.		785	2,670	30 – 40	200
1.900 Tbg.		862	2,500	25 – 35	220
1.660 Tbg.		916	2,200	20 – 30	125
1.315 Tbg.		1,033	1,860	20 – 30	120
2-7/8 Tbg.	70209	410	3,570	15 – 25	145
2-3/8 Tbg.		360	2,140	15 – 25	135
2-1/16 Tbg.		536	2,140	15 – 25	120
1.900 Tbg.		534	1,550	10 – 20	125
2-7/8 D.P.	41727	142	1,480	20 – 30	200
2-3/8 D.P.		186	1,240	20 – 30	180
2-7/8 Tbg.		275	1,780	15 – 25	130
2-3/8 Tbg.		290	1,360	15 – 25	120
2-1/16 Tbg.		345	1,140	10 – 20	100
1.900 Tbg.		388	1,128	10 – 20	125
3-1/2 D.P.	34551	814	12,620	45 – 55	230
3-1/2 Tbg.		1,650	16,800	30 – 40	180
2-7/8 Tbg.		1,320	8,586	20 – 30	220
2-3/8 Tbg.		1,470	6,900	15 – 25	225
2-1/16 Tbg.		1,794	6,100	15 – 25	210
4 Tbg.	51148	436	4,800	30 – 40	200
3-1/2 Tbg.		387	3,600	20 – 30	160
2-7/8 Tbg.		415	2,700	15 – 25	125
2-3/8 Tbg.		500	2,350	15 – 25	135
5 D.P.	35957	460	9,040	10 – 20	180
4-1/2 D.P.		350	7,030	10 – 15	160
4 D.P.		393	6,170	10 – 15	160
3-1/2 D.P.		330	5,160	10 – 15	140

NOTE : These are maximum static loads. If shock loaded, reduce values 50%.

Hydraulic External Cutters

Assembly No.	O.D.	I.D.	Piston Segment Assembly No.	Size	Maximum O.D. Piston Segment Will Pass
70086	3-3/4	2-7/8	70091	2-1/16	2-3/4
			70094	1.900	2-7/16
			70097	1.600	2-3/8
			70100	1.315	2-5/16
34415	4-1/16	3-3/16	34425	2-3/8	3-1/16
			34427	2-1/16	2-7/8
			34429	1.900	2-13/16
			34432	1.660	2-11/16
			34434	1.315	2-9/16
70209	4-7/16	3-5/8	70232	2-7/8	3-7/16
			70214	2-3/8	3-3/16
			70217	2-1/16	3-1/8
			70219	1.900	3-1/16
41727	4-11/16	3-7/8	41733	2-7/8	3-3/4
			41736	2-3/8	3-9/16
			41738	2-1/16	3-3/8
			41740	1.900	3-3/8
34551	5-5/8	4-5/16	53881	4	4-3/16
			34559	3-1/2	4-1/8
			34562	2-7/8	4-1/16
			34565	2-3/8	4
			34568	2-1/16	4
51148	6-1/16	4-7/8	51151	4	4-13/16
			51230	3-1/2	4-3/4
			51345	2-7/8	4-5/8
			51344	2-3/8	4-1/2
35957	8	6-1/2	35963	5	6-3/8
			35966	4-1/2	6-1/4
			35968	4	5-7/8
			35971	3-1/2	5-7/8

Bowen Hydraulic External Cutters

Size Pipe to Cut		1.315 – 2-1/16	1.315 – 2-3/8	1.900 – 2-7/8	1.900 – 2-7/8	2-1/16 – 4	2-3/8 – 4	3-1/2 – 5
Maximum Size Cutter Will Pass Over								
When Dressed with Largest Size Piston		2-3/4	3-1/16	3-1/2	3-3/4	4-3/16	4-13/16	6-3/8
Cutter ID		2-7/8	3-3/16	3-5/8	3-7/8	4-5/16	4-7/8	6-1/2
Cutter OD		3-3/4	4-1/16	4-7/16	4-11/16	5-5/8	6-1/16	8
Minimum Size Hole to Run In		4	4-5/16	4-11/16	4-15/16	5-7/8	6-1/4	8-1/2
Complete Assembly	Part No.	70086	34415	70209	41727	34551	51148	35957
	Weight	55	60	73	85	95	105	230

Replacement Parts

Top Sub	Part No.	70087	34416	70210	33081	33574	13177	35958
	Weight	21	23	24	25	28	31	60
Body	Part No.	70088	34417	70211	41728	34552	56992	35959
	Weight	16	20	23	26	31	29	73
Feed Ring	Part No.	70089	49819	70212	49824	49829	51150	49834
	Weight	1	1	1	4	5	5	7
Shear Pin	Part No.	14205	14205	14205	14205	34555	7227	34555
	No. Req'd.	2	2	2	2	2	2	2
Knife	Part No.	80147	34421	33088	33088	34553	12382	35960
	No. Req'd.	5	5	5	5	5	5	5
Knife Pin	Part No.	80148	34422	33089	33089	34554	37022	34554
	No. Req'd.	5	5	5	5	5	5	5
Knife Pin Set Screw	Part No.	23654	23666	23666	23666	23703	—	23703
	No. Req'd.	5	5	5	5	5	—	5
Feed Ring O-Ring	Part No.	568235	568237	568241	568243	568247	568251	568438
Guide	Part No.	70090	34424	70213	33093	187	13412	35962
Guide Screw	Part No.	34418	34418	34418	34418	34556	51149	34556
	No. Req'd.	2	2	2	2	2	2	2
Piston Assembly	Part No.	70091	34425	70232	41733	34559	51151	35963
	Size	2-1/16	2-3/8	2-7/8	2-7/8	3-1/2	4	5
Piston Segment Set	Part No.	70092	49814	70233	49825	49830	51152	49821
Rubber Ring	Part No.	70093	34564	34564	34564	34561	51153	35965
Piston O-Ring — for All Assemblies		568234	568236	568235	568237	568246	568250	568259

Optional

Optional Piston Assembly	Part No.	70094	34427	70214	41736	34562	51230	35966
	Size	1.900	2-1/16	2-3/8	2-3/8	2-7/8	3-1/2	4-1/2
Piston Segments	Part No.	70095	49817	70215	49828	49831	51231	49823
Rubber Ring	Part No.	70096	34567	34567	34567	34564	34561	35965
Optional Piston Assembly	Part No.	70097	34429	70217	41738	34565	51345*	35968
	Size	1.660	1.900	2-1/16	2-1/16	2-3/8	2-7/8	4
Piston Segments	Part No.	70098	49818	70218	49826	49832	51346	49822
Rubber Ring	Part No.	70096	34567	34567	34567	34564	34564	35970
Optional Piston Assembly	Part No.	70100	34432	70219	41740	34568	51344*	35971
	Size	1.315	1.600	1.900	1.900	2-1/16	2-3/8	3-1/2
Piston Segments	Part No.	70101	49815	70220	49827	49833	51343	49820
Rubber Ring	Part No.	70102	34431	34567	34567	34567	34564	35970
Optional Piston Assembly	Part No.	—	34434	—	—	53881	—	—
	Size	—	1.315	—	—	4	—	—
Piston Segments	Part No.	—	49816	—	—	53880	—	—
Rubber Ring	Part No.	—	34436	—	—	51153	—	—

*Use O-Ring 568249

Miscellaneous O-Ring Seals are normally furnished in sealed plastic bags of 10, 25, or 100 pieces each to prevent deterioration. Other quantities will be furnished in unsealed packages. Packing Sets, however, will always be furnished in sealed plastic bags.

How to Order

Specify:

- (1) Name and number of assembly or part
- (2) Size and types of pipe to cut
- (3) Connection size and type

RECOMMENDED SPARE PARTS:

- (1) 1 Set Piston Segments
- (2) 1 Feed Ring
- (3) 24 Shear Pins
- (4) 6 Sets Knives
- (5) 2 Sets of Knife Pins
- (6) 1 Set Knife Pin Screws
- (7) 6 Rubber Rings
- (8) 6 Piston O-Rings
- (9) 6 Feed Rig O-Rings

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Corporate Headquarters

10000 Richmond Avenue
Houston, Texas 77042
United States
Phone: 713 346 7500
Fax: 713 346 4493

California

4117 Atlas Court
Bakersfield, California 93308
United States
Phone: 661 395 0165
Toll Free: 800 328 0038
Fax: 661 328 1827

Louisiana

108 Nova Drive
P.O. Box 466
Broussard, Louisiana 70518
United States
Phone: 337 839 2400
Toll Free: 800 585 5697
Fax: 337 839 2211

190 Thompson Road
Houma, Louisiana 70363
United States
Phone: 985 851 1111
Fax: 985 851 1117

New Mexico

14 County Road 5860
P.O. Box 383
Farmington, New Mexico 87401
United States
Phone: 505 326 4303
Fax: 505 326 4304

North Dakota

3202 1st Avenue West
P.O. Box 731
Williston, North Dakota 58802
United States
Phone: 701 774 0091
Fax: 701 774 0092

Oklahoma

3800 Thomas Road
Oklahoma City, Oklahoma 73179
United States
Phone: 405 677 2484
Toll Free: 877 760 1711
Fax: 405 682 0147

Texas

2710 Highway 281 North
P.O. Box 801
Alice, Texas 78332
United States
Phone: 361 664 8013
Fax: 361 664 0462

2810 Highway 135 North
P.O. Box 1888
Kilgore, Texas 75662
United States
Phone: 903 984 2553
Fax: 903 984 7170

10720 West I-20 East
Odessa, Texas 79765
United States
Phone: 432 563 1173
Fax: 432 563 1182

30444 Southwest Freeway
P.O. Box 1595
Rosenberg, Texas 77471
United States
Phone: 281 341 5365
Toll Free: 800 248 8665
Fax: 281 344 1986

Utah

1553 East Highway 40
P.O. Box 482
Vernal, Utah 84078
United States
Phone: 435 789 0670
Fax: 435 789 6568

Wyoming

778 Circle Drive
Casper, Wyoming 82601
United States
Phone: 307 237 3100
Fax: 307 237 2546

Canada

540 5th Avenue SW, Suite 1010 (Office)
540 5th Avenue SW, Suite 1100 (Mailing)
Calgary, Alberta T2P 0M2
Canada
Toll Free: 877 645 8665
Fax: 403 294 5790

9118 34A Avenue
Edmonton, Alberta T6E 5P4
Canada
Phone: 780 944 3965
Fax: 780 461 4077

9120 34A Avenue
Edmonton, Alberta T6E 5P4
Canada
Phone: 780 702 5209
Fax: 780 463 2348

11453 98th Avenue
Grand Prairie, Alberta T8V 5S5
Canada
Phone: 780 539 9366
Fax: 780 539 9207

Germany

Eddesser Strasse 1
Edemissen Berkhöpen 31234
Germany
Phone: 49 5176 9767 0
Fax: 49 5176 9767 22

Indonesia

Cilandak Commercial Estate, Unit 105
Jalan Raya Cilandak KKO
P. O. Box 7541
Jakarta 12560
Indonesia
Phone: 6221 782 6088
Fax: 6221 782 6086

Jalan Mulawarman, No. 47 Rt. 32 Km. 20
Manggar, Balikpapan 76166
Indonesia
Phone: 62 542 772 114
Fax: 62 542 772 113

Malaysia

Menara Citibank, Level 36
165 Jalan Ampang
Kuala Lumpur 50450
Malaysia
Phone: 603 2169 6223
Fax: 603 2169 6224

Singapore

8 Sixth Lok Yang Road
Jurong Town
Singapore 628106
Phone: 65 6265 5066
Fax: 65 6265 7746

United Arab Emirates

R/A 13 Daimler Chrysler Street, Plot MO 0682
P. O. Box 61490
Jebel Ali Free Zone, Dubai
United Arab Emirates
Phone: 9714 883 8776
Fax: 9714 883 8795

United Kingdom

2 Isbourne Way
Winchcombe
Cheltenham, Gloucestershire GL54 5NS
England
Phone: 44 1242 603975
Fax: 44 1242 602614

Badentoy Crescent
Badentoy Park
Portlithen, Aberdeen AB12 4YD
Scotland
Phone: 44 1224 343610
Fax: 44 1224 878775

Unit 10 Kirkton Avenue
Pitmedden Road Industrial Estate
Dyce, Aberdeen AB21 0BF
Scotland
Phone: 44 1224 334800
Fax: 44 1224 723034

Manufacturing and Engineering Centers

3550 93rd Street
Edmonton, Alberta T6E 5N3
Canada
Phone: 780 944 3929
Fax: 780 430 0760

16211 Air Center Boulevard
Houston, Texas 77032
United States
Phone: 713 346 7500
Fax: 713 346 4493

Holton Road
Holton Heath Trading Estate
Poole, Dorset BH16 6LT
England
Phone: 44 1202 631817
Fax: 44 1202 631708

Downhole Solutions

Drilling Solutions

Engineering and Project Management Solutions

Lifting and Handling Solutions

Production Solutions

Supply Chain Solutions

Tubular and Corrosion Control Solutions